



## Assessing South American Corn and Soybean Yield Risks: Exploring the Data Sources

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We have extensively analyzed the history of U.S. corn and soybean yields and deviations from trend yield as a basis for evaluating annual yield risk in the U.S. Examples include the *farmdoc daily* articles of [February 26, 2015](#) and [March 19, 2015](#), which examine the history of yield deviations from trend values not adjusted for growing season weather, and [March 2, 2016](#) and [March 9, 2016](#), which examine the history of yield deviations in years of El Niño episodes. Here, we start a series of articles that evaluate the history of corn and soybean yields and deviations from trend yield in Brazil and Argentina. Yield and production in those two countries have become increasingly important in determining the price of corn and soybeans as production and exports have expanded rapidly.

### Background

Corn production in Brazil, for example, increased by 120 percent during the 20 years ending in 2016, while Argentine production increased by 80 percent. At the same time, soybean production increased by 260 percent in Brazil and by 450 percent in Argentina. For the 2014-15 marketing year, Brazil accounted for eight percent of world corn production and 24 percent of world exports and Argentina accounted for three percent of production and 13 percent of exports. Brazil accounted for 30 percent of world soybean production and 40 percent of world exports and Argentina accounted for 19 percent of production and eight percent of exports. The two countries also accounted for 67 percent of world soybean meal exports and 60 percent of world soybean oil exports. Each year, then, the size of the corn and soybean crops in Brazil and Argentina has a strong influence on the price of those two crops. There is special interest in 2017 yield and production prospects in those two countries for at least three reasons. First, yield and production in Brazil and Argentina were reduced in 2016 due to adverse weather conditions. The largest impacts were on corn in Brazil and soybeans in Argentina. Second, a weak to moderate La Niña episode is underway which may have some influence on growing season weather in those two countries. Third, Argentina is expected to sharply increase corn acreage due to reductions in corn export taxes.

### Yield Data

Identifying and evaluating corn and soybean yield data for Brazil and Argentina is more complicated than for the U.S. In the U.S., one USDA agency, the National Agricultural Statistics Service (NASS), has the

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responsibility for estimating yields. Those estimates are based on extensive data collection and statistical analysis as detailed in the publication [The Yield Forecasting Program of NASS](#). We have written extensively about U.S. corn and soybean yield forecasts issued by NASS ([Good and Irwin, 2006](#); [Good and Irwin, 2011](#); [Irwin, Sanders and Good, 2014](#); *farmdoc daily*, [August 28, 2013](#); [August 29, 2014](#); [August 18, 2016](#); [August 26, 2016](#)). In contrast, yield estimates for Brazil and Argentina are provided by at least three agencies. For both Brazil and Argentina, these include the [Food and Agriculture Organization of the United Nations \(FAO\)](#) and the [USDA's Foreign Agricultural Service \(FAS\)](#). In addition, in-country estimates for Brazil are provided by [CONAB](#), The National Food and Supply Company, which is a public company allied with the Ministry of Agriculture, Livestock, and Supply for evaluating crop data. In-country estimates for Argentina are provided by the [Argentina Ministry of Agribusiness](#). The yield estimating methodology used by these organizations is very different than used by NASS to make yield estimates for the U.S. To the best of our knowledge, these organizations use satellite data, information from field operators, and various statistical methodologies to derive area and yield estimates. The FAO calculates area and crop production data on the calendar year using figures supplied by member countries. Most of the data is accumulated via annual FAO questionnaires. The FAS makes production, supply, and distribution estimates from a variety of information sources on a marketing year basis for corn and soybeans. These sources include official country statistics, foreign agricultural attaché reports, and a variety of other information sources available to the organization.

Yield estimates provided by FAO are readily available for both countries for the period 1961 through 2014 for corn and soybeans. FAS yield estimates are readily available for corn for both countries from 1961 through 2016 and for soybeans from 1978 through 2016. In-country yield estimates are readily available for Argentina from 1970 through 2016 and for Brazil from 1977 through 2016. These yield estimates are shown in Tables 1 and 2. The yield estimates have been converted from metric units and reported as bushels per acre. Brazilian corn yield estimates are weighted averages of the first and second crops by using production and planted acreage for each crop during the year to calculate corn yield.

In general, the FAO corn and soybean yield estimates tend to be very consistent with in-country estimates for Argentina in the years that overlap. That is, FAO tends to accept and report in-country estimates. The one exception is the nearly four bushel difference in 2014. There have been frequent, but generally small differences between FAO and in-country corn and soybean estimates for Brazil. Yield estimates provided by FAS have frequently deviated by small amounts from both FAO and in-country estimates. However, some differences are large. Most notable are the 2006 Argentine corn yield estimates and the 1998 Brazilian soybean estimates.

While corn and soybean yield estimates from various sources tend to track fairly closely over time for both countries, frequent small differences and occasional large differences have occurred. To accurately assess future yield risks based on historical yields, it is best to use the "correct" historical yield series. Since FAO and in-country estimates are nearly identical, the choice is between FAO and FAS yield estimates. Based on our understanding of the methodology used by the agencies, we believe that FAS estimates likely reflect the most rigorous reconciliation of area, production, and yield estimates. We will use FAS yield estimates in future articles to evaluate yield risks for both crops for both countries, even though that choice results in fewer observations for soybean yields.

Figures 1 and 2 present the FAS yield estimates for corn from 1961 through 2016 and for soybeans from 1978 through 2016. Average yields for both crops in both countries have trended higher with frequent deviations above and below trend. Argentina corn yields have historically been higher than in Brazil, but rapid growth in Brazilian yields in the last decade has reduced the gap. Soybean yields in Argentina exceeded yields in Brazil through the 1980s, but yields have generally been in the same range since that time.

## Implications

There are at least three sources of corn and soybean yield estimates for Brazil and Argentina, including those provided by the FAS of the USDA, FAO of the UN, and in-country agencies. FAO and in-country estimates are nearly identical for most years, while FAS estimates have deviated somewhat from the other two sources. We will use historical yield estimates provided by FAS in future articles to evaluate corn and soybean yield risk for 2017 in both countries based on historical deviations from trend yields not adjusted for growing season weather and adjusted for years La Niña conditions existed.

**Table 1. National Average Corn Yield for Argentina and Brazil from Alternative Sources, 1961-2016**

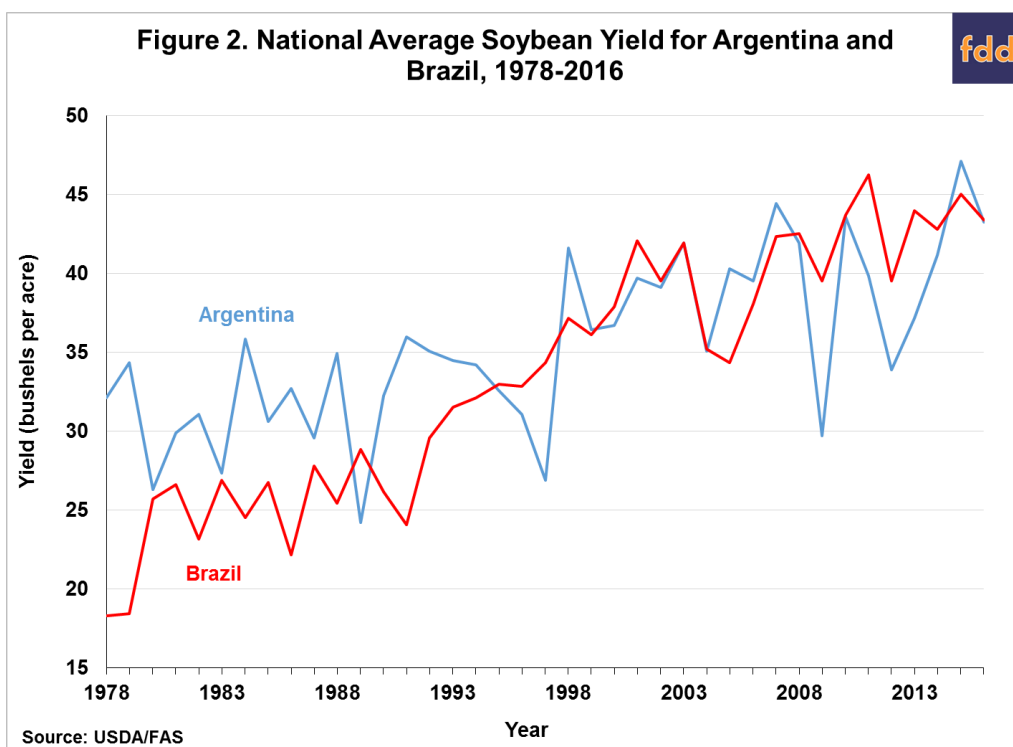
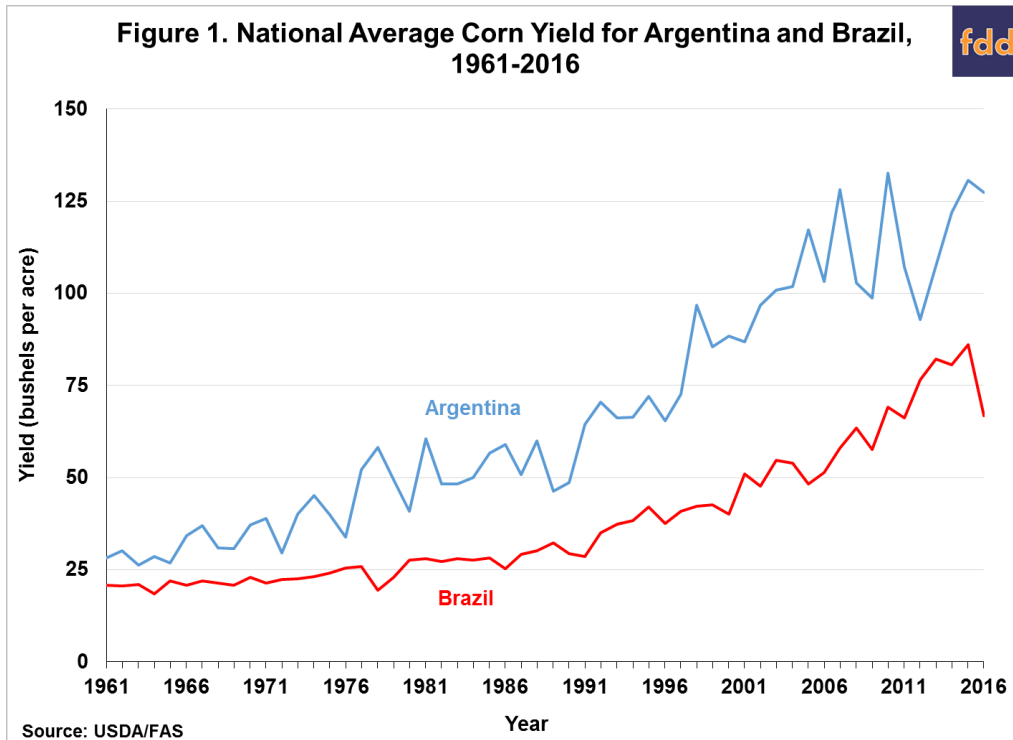
	Argentina			Brazil		
	FAO-UN	FAS-USDA	ArgMin	FAO	USDA-FAS	CONAB
	---bushels per acre---			---bushels per acre---		
1961	28.2	28.2		20.9	20.9	
1962	30.2	30.1		20.8	20.7	
1963	26.3	26.3		20.9	21.0	
1964	28.7	28.7		18.5	18.5	
1965	26.7	26.8		22.0	22.0	
1966	34.3	34.3		20.8	20.9	
1967	39.3	37.0		22.0	22.0	
1968	30.9	30.9		21.3	21.3	
1969	30.7	30.7		20.9	20.9	
1970	37.1	37.1	37.1	23.0	22.9	
1971	38.9	38.9	38.9	21.3	21.3	
1972	29.7	29.6	29.7	22.5	22.5	
1973	43.3	40.1	43.4	22.8	22.6	
1974	45.2	45.2	45.2	24.3	23.1	
1975	40.0	40.0	40.0	24.0	24.1	
1976	33.7	33.8	33.7	25.4	25.5	
1977	52.2	52.3	52.2	26.0	26.0	26.0
1978	58.1	58.2	58.1	19.4	19.4	20.3
1979	49.5	49.4	49.5	23.0	22.9	23.3
1980	40.9	40.9	40.9	28.3	27.7	26.5
1981	60.6	60.5	60.6	29.2	28.0	27.9
1982	48.2	48.3	48.2	27.6	27.2	27.0
1983	48.3	48.3	48.3	27.9	28.0	26.0
1984	50.0	50.0	50.0	28.1	27.7	27.6
1985	56.8	56.7	56.8	29.7	28.2	28.3
1986	59.7	58.9	59.7	26.3	25.3	24.7
1987	50.8	50.8	50.8	31.6	29.2	29.2
1988	60.1	60.1	60.1	29.9	30.1	30.0
1989	46.4	46.4	46.4	32.8	32.3	32.3
1990	55.1	48.8	55.1	29.8	29.3	29.3
1991	64.4	64.4	64.4	28.8	28.7	28.5
1992	72.1	70.4	72.1	36.4	35.0	34.9
1993	69.4	66.3	69.4	40.3	37.4	37.4
1994	67.5	66.4	67.5	37.6	38.4	37.3
1995	72.0	72.0	72.1	41.4	42.1	41.8
1996	64.4	65.5	64.4	43.0	37.6	37.5
1997	72.6	72.6	72.6	41.8	40.9	41.2
1998	96.8	96.9	96.8	44.6	42.2	42.2
1999	85.6	85.6	85.6	44.0	42.7	41.2
2000	86.6	88.4	86.6	43.7	40.1	39.5
2001	86.9	86.8	86.9	54.2	51.0	51.9
2002	96.9	96.9	96.8	48.7	47.8	45.7
2003	103.2	100.8	103.9	59.4	54.6	57.1
2004	101.9	101.8	102.3	53.6	53.8	52.5
2005	117.2	117.3	117.2	48.4	48.3	45.7
2006	94.0	103.2	94.0	53.9	51.5	52.2
2007	122.1	128.1	122.1	60.3	58.0	58.2
2008	102.8	102.8	102.8	65.0	63.6	63.3
2009	88.8	98.8	88.6	59.2	57.7	57.3
2010	124.3	132.7	124.3	69.6	69.1	68.7
2011	101.2	107.1	101.2	67.1	66.3	66.2
2012	91.4	92.9	91.4	79.7	76.5	76.6
2013	105.2	107.5	105.2	83.7	82.2	82.0
2014	105.1	121.9	109.0	82.5	80.6	80.6
2015		130.6	116.4		86.0	86.0
2016		127.5	118.7		66.8	66.7

Notes: FAO-UN: Food and Agricultural Organization of the United Nations. FAS-USDA: Foreign Agricultural Service of the U.S. Department of Agriculture. ArgMin: Argentina Ministry of Agribusiness. CONAB: National Food Supply Agency of Brazil.

**Table 2. National Average Soybean Yield for Argentina and Brazil from Alternative Sources, 1961-2016**

	Argentina			Brazil		
	FAO-UN	FAS-USDA	ArgMin	FAO	USDA-FAS	CONAB
	---bushels per acre---			---bushels per acre---		
1961	14.5			16.8		
1962	17.3			16.4		
1963	14.6			14.1		
1964	17.0			12.6		
1965	15.4			18.0		
1966	17.2			18.0		
1967	17.6			17.4		
1968	16.2			13.5		
1969	16.8			17.3		
1970	15.3		15.3	17.0		
1971	24.1		24.1	18.0		
1972	17.1		17.1	21.9		
1973	25.8		25.8	20.6		
1974	22.1		21.4	22.8		
1975	20.3		20.3	25.3		
1976	23.8		23.8	26.0		
1977	31.5		31.5	26.3		26.0
1978	32.3	32.1	32.3	18.2	18.3	18.6
1979	34.4	34.3	34.4	18.4	18.4	18.6
1980	25.6	26.3	25.6	25.7	25.7	25.3
1981	29.8	29.9	29.8	26.2	26.6	26.5
1982	31.1	31.1	31.1	23.3	23.2	22.8
1983	26.1	27.4	26.1	26.6	26.9	25.7
1984	35.8	35.8	35.8	24.5	24.5	24.9
1985	29.6	30.6	29.6	26.8	26.8	26.9
1986	31.8	32.7	31.8	21.6	22.2	20.4
1987	28.2	29.6	28.2	27.7	27.8	27.5
1988	33.7	34.9	33.7	25.5	25.4	25.2
1989	24.6	24.2	24.6	29.3	28.8	29.0
1990	32.1	32.3	32.1	25.8	26.2	25.9
1991	33.8	36.0	33.8	23.1	24.1	23.5
1992	34.1	35.1	34.1	30.3	29.6	30.1
1993	32.1	34.5	32.1	31.6	31.5	32.0
1994	30.3	34.2	30.3	32.2	32.1	32.4
1995	30.4	32.6	30.4	32.7	33.0	33.0
1996	31.3	31.1	31.3	33.5	32.9	32.3
1997	25.6	26.9	25.6	34.2	34.3	34.2
1998	40.1	41.6	40.1	35.0	37.2	35.5
1999	36.4	36.4	36.4	35.3	36.1	35.2
2000	34.7	36.7	34.7	35.7	37.9	35.9
2001	38.4	39.7	38.4	41.6	42.1	40.9
2002	39.1	39.1	39.1	38.9	39.6	38.3
2003	41.7	41.9	41.7	41.7	41.9	41.9
2004	32.8	35.1	32.8	34.2	35.2	34.6
2005	40.6	40.3	40.6	33.2	34.3	33.4
2006	39.8	39.6	39.8	35.4	38.1	36.0
2007	44.2	44.5	44.2	41.8	42.4	42.0
2008	42.0	41.9	41.9	41.9	42.5	41.9
2009	27.5	29.7	27.5	39.2	39.6	39.1
2010	43.2	43.6	43.2	43.8	43.7	43.5
2011	38.7	39.9	38.8	46.4	46.2	46.3
2012	33.9	33.9	33.9	39.2	39.6	39.4
2013	37.8	37.2	37.8	43.5	44.0	43.7
2014	41.2	41.2	41.2	42.6	42.8	42.4
2015		47.1	47.2		45.1	44.6
2016		43.3	44.5		43.4	42.7

Agricultural Service of the U.S. Department of Agriculture. ArgMin: Argentina Ministry of Agribusiness. CONAB: National Food Supply Agency of Brazil.



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